THE FEEDING VALUE OF A CERTAIN FEED MIXTURE AND EXTRACTED RICE BRAN USING DIGESTIBILITY TRIALS WITH SHEEP

By

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SUMMARY

Four digestion trials with duplicate sheep were undertaken using clover hay as. basal ration, to study the feeding value of extracted rice bran (1.72% fat) and a concentrate feed mixture containing 65% undecorticated cotton-seed cake, 20% wheat bran, 12% rice bran (unextracted), 2% ground lime stone and 1% common salt. The mixture contained 23.16% protein, 8.72% fat, 18.60% fibre, 32.10% soluble carbohydrates and 12.25% ash. The digestion coefficients of the last four ingredients were found to be 77.98, 72.56, 34.10 and 72.91% respectively, the total digestible nutrients being 63.71% and the starch value being 56.18%. The feeding value calculated from the differeint ingredients using Ghoneim's figures for starch value, was 57.69 being only 2.7% higher, indicating the possibility of relying on the calculated feeding value of feed mixtures of similar ingredients. With extracted rice bran the analysis was 12.35% protein, 1.72% fat, 10.06% fibre, 48.65% soluble carbohydrates and 15.22% ash being within the legislative analysis except with ash (not less than 12% protein and 42% N.F.E., and not more than 2% fat, 11%crude fibre and 12% ash). Digestion coefficients were found to be 80.93, 120.15, 35.10 and 75.07% for protein, fat, fibre and N.F.E. respectively with a total digestible nutrients of 53.91 and a starch value of 50.07%. The feeding value is ca. 75% of the unextracted rice bran. The variation in composition and digestion coefficients of clover hay as a basal ration were discussed.

INTRODUCTION

Few years ago, it was realised in feeding practice with farm animals, that using a suitable feed mixture rather than single feeds, would be better physiologically and nutritionally. The authorities started to support this view opening the field for mixing and manufacturing feeding-stuff for animals. At the beginning, a certain feed mixture was officially accepted having some specifications. The mixture was to be composed of 65% undecorticated cotton-seed cake, 20% wheat bran, 12% rice bran, 2% ground lime stone and 1% common salt. Some individuals prepared the mixture using mechanical mixers to prepare it for sale. The mixture should not contain more than 18% crude fibre and less than 17% crude protein and 2.5% fat. The mixture was sacked loose without cubing. Later on, improvement occurred by adding molasses and cubing or peletting in some cases along with more restricted specifications and control.

Moreover, it was decided to extract the fat from rice bran which was marketed containing up to 14.63% fat (6). This was for duel purposes, to raise the keeping quality of the product and to make use of the extracted oil for other purposes.

Therefore, it was necessary to determine the feeding value of both the concentrate mixture and the extracted rice bran. It was of interest to find out the effect of reducing the fat content on the relative proportion of other nutrients, their digestion coefficients and finally the feeding value.

The present data about the analyses of the ordinary rice bran (not extracted) in Egypt indicated that the range of percentage analyses did not exceed 3 degrees of percentage being 90.41 - 92.13 for dry matter, 12.61-15.09 for crude protein, 11.86 - 14.63 for crude fat, 6.77 - 8.61 for crude fibre, 43.74-45.77 for soluble carbohydrates (N.F.E.) and 9.50- 12.43% for ash (5, 6, 8). The digestion coefficient with crude fibre was the lowest (25.7- 49%) while with other nutrients it was ca. 70 or more being 69.8-83.8 with protein, 72-92.1 with fat and 70.6 - -80.0 with N.F.E. The recorded feeding value was 63.7 to 70.9% starch value with a corresponding 68.0 to 73.1% T.D.N. The rice bran recorded by Schneider (9) with sheep had a similar composition but was relatively high in crude fibre (12.9%). The digestion coefficients were within the range mentioned above. Kellner's rice feeding meal was found to have a composition similar to that published here with similar but slightly wider range in the coefficients of digestion (7) .

Recently, the Ministry of Agriculture published the results with an extracted sample of rice bran during the first trials of extraction (8). The sample contained 14.14% protein, 4.07% fat, 11.42% crude fibre and 50.60% N.F.E. The percentages of nutrients increased when fat was extracted. The digestion coefficients were 70.7 for protein, 93.4 for ether extract, 25.4 for crude fibre and 75.1 for N.F.E. The feeding value was 58.3 S.V. (58.4.T.D.N.) being lower by ca. 10 degrees of percentage, but the sample contained higher fat percentage than the limit recently legislated (not more than 2%) . Therefore, the feeding value of later extracted sample of rice bran was investigated with sheep in digestion trials.

EXPERIMENTAL AND METHODS

Four digestibility trials with duplicate adult rams were performed: using two lots of hays (Hay 1 and Hay 2) as basal rations, one with the feed mixture along with Hay 1 and the fourth with extracted rice bran along with Hay 2. Each basal ration was used for determining indirectly the feeding value of the tested ration used with it.

The preliminary period was ten days and the collection period was 9 days with the feed mixture and 10 days with rice bran.

The daily consumption was 500 g. from Hay 1 along with 500 g. feed mixture (455.6 : 474.2 g. on dry matter basis); it was 700 g. Hay 2 along with 400 g. rice bran (602 : 352 g. dry matter).

The methods of summative analysis followed the official ones of the A.O.A.C. (2) with slight modifications using duplicate or triplicate samples of 2-3 g. each.

Drying faeces was at 105° C and ashing at 600° C in a Muffle furnace for not less than thirty minutes; Kjeldahl method was used for protein determination (N x 6.25) using mercury as a catalyst (0.7 g.Hg + 30 ml H_2 $S0_4$ conc.). Ethyl ether was used for fat extraction in Soxhlet apparatus provided with a cold water condenser (8° C) for not less than 8 hrs. (rate of syphoning 6/hr.). Crude fibre was determined in defatted material boiling in a suitable beaker keeping the volume constant by adding boiling water, then finally washing with 5% HCl, then H_2 o, EtOH and ether. For filtration an asbestos mat was prepared over a wire gauze fixed in a copper ring fitted to an ordiary funnel attached to a vacuum pump as described by Ghoneim et al (5). The N.F.E. was determined by difference.

Kellner's method (7) was used for calculating the feeding value as starch value but giving the digestible crude protein the full value as digestible true protein. The crude fibre deduction was 0.3/unit percentage of crude fibre as used by Ghoneim (6) in similar concentrated feeds instead of using the value number.

RESULTS AND DISCUSSIONS

Results with the two basal rations

The two lots of hays were similar in summative analysis particularly on dry matter basis, and although two different duplicate sheep were used for each lot the digestion coefficients of the nutrients were approaching one another in both hays as in the following table :

	Dry matter	Crude protein	Ether extract	Crude fibre	N.F.E	Ash.
Hay 1	%	%	%	%	%	%
Analysis as fed	91.12	16.92	4.40	24.05	32.10	13.65
Analysis dry	100.00	18.55	4.82	26.39	35.22	14.97
Digestion coeff. . . .	—	66.43	64.80	45.23	73.43	—
Hay 2						
Analysis as fed	86.00	15.76	3.38	23.10	31.30	12.46
Analysis dry	100.00	18.32	3.93	26.86	36.40	14.97
Digestion coeff.	—	64.23	59.88	49.59	69.44	—

The difference with any nutrient was not exceeding 5 degrees of percentage.

But by inspecting the composition of various lots of clover hay published in Egypt including the two lots here totaling 14 samples (3, 4, 5 6, 8), the following ranges in composition as offered and digestion coefficients of hay mutrients in 9 trials (2, 4, 5, 6, 8) were obtained :

	Dry Matter	Crude protein	Ether Extract	Crude fibre	N.F.E.	Ash
	%	%	%	%	%	%
Analysis						
Minimum	81.47	10.04	0.70	18.24	28.62	9.65
maximum	92.05	16.92	4.40	30.56	45.64	17.21
Coefficients						
minimum	—	53.63	18.93	45 23	56.17	—
maximum	—	76.05	68.15	60.76	73.43	—

This comparison indicated clearly that there is a wide variation in composition of various lots of hays depending on variable factors such as its moisture content, stage of cutting the green clover, the order of the cut and the losses during the curing of hay. The wide range in composition was accompanied by a wide range in digestion coefficient. These facts would necessitate that in digestion trials, the same lot of hay used as a basal ration must be used with the tested ration. Relying on the composition of the basal hay and using the digestion coeffieients of another lot or even average digestion coefficients from previous trials with hay, would decidedly result in serious errors in the digestion coefficients of the tested ration calculated indirectly in the usual way.

Composition digestion coefficients and feeding value of the food mixture

Results in Table 1 indicated that addition of rice bran and wheat bran to the undecorticated cotton seed cake reduced the crude fibre to 18.60% and the crude protein to 23.16% when compared with the cako alone.

The agreement in digestion coefficients between the duplicate rams was satisfactory, the greatest difference was with dry matter being 63.59% in one ram and 55.70% in the other. This difference was apparent due to the fact that faecal material from the former ram contained lower ash content (14.26%) against higher ash in the latter (18.99%). The digestion coefficients of the crude fibre was the lowest being 34.1% while it was exceeding 70% in other nutrients being the highest with crude protein (77.98%).

The N.F.E. has the highest share in digestible nutrients being 23. 40%, the next being the digestible protein (18.06%). Although the digestible crude fat was 7.05%, its value for calculating the feeding value was over 15%. The digestible crude fibre was low being 6.43% and its share in feeding value after crude fibre deduction would be very minute not exceeding 0.6%.

The starch value of the mixture as fed reached 56.68 %approaching that of a good quality undecorticated cotton seed cake,the corresponding T.D.N. was 63.71%. The feeding values of the dry matter were59.75% as starch value and 67.18% as T.D.N. The relatively high digestible protein in the product having a narrow nutritive ratio (1 : 2.53) would render the mixture suitable for wide application in feeding practice for growth and milk production particularly with ruminants.

When the starch value of the feed mixture was calculated from the known feeding value of its ingredients (6), it was found to be 57.69 being similar to that obtained experimentally in the digestion trial.

Scientifically, such feed mixture would have a better feeding quality concerning the presence of more essential amino acids and elements owing to the complimentary effect when mixing food ingredients from different sources.

Composition, digestion coefficients and feeding value of extracted rice bran

The sample contained 1.72% fat being within the legislated limit. The crude fibre, N.F.E. and ash were higher than the higher limit published for ordinary unextracted rice bran being 10.06, 48.65 and 15.22% (Table 1).

The coefficient of digestion for protein, crude fibre and N.F.E. were within the range published for them (5, 6,8) but was of higher order with crude fat (120.15%).

The digestible N.F.E. composed the major part of digestible nutrients (36.52%) followed by digestible protein (9.99%). The share of dgestible fat was relatively small (1.72%) while the crude fibre, after the deduction, had a negligible share (ca. 0. 52%).

The starch value of the extracted rice bran was found to be 50.07 as fed and 56.89 in the dry matter. The corresponding T.D.N. was 53.91 and 61.26. The feeding value of the extracted rice bran was ca. 8 degrees less than that of the extracted rice bran containing 4.07% fat (8). Assuming the average starch value for the unextracted rice bran to be 65, the feeding value of the extracted rice bran would be ca. 75% of the unextracted rice bran. Therefore, in feeding practice for ruminants, four kilograms of extracted rice bran would equal 3 kilograms of the unextracted one.

TABLE 1.—**Nutritive analysis, digestion coefficients and feeding value of the feed mixture and extracted rice bran**

Item	Dry matter	Crude protein	Ether extract	Crude fibre	N.F.E.	Ash	Starch value	T.D.N.
	%	%	%	%	%	%	%	%
Feed mixture *								
Analysis airdried and feeding value	94.83	23.16	8.72	18.60	32.10	12.25	56.68	63.71
Analysis dry matter and feeding value	100.00	24.43	9.20	19.62	33.86	12.87	59.75	67.18
Digestion coefficients	59.64	77.98	72.56	34.10	72.91	—	—	—
Digestible nutrients air dried	56.56	18.06	7.05	6.43	23.40	—	—	—
Extracted Rice bran †								
Analysis air dried and feeding value	88.00	12.35	1.72	10.06	48.65	15.22	50.07	53.91
Analysis dry matter and feeding value	100.00	14.03	1.96	11.43	54.88	17.30	56.89	61.26
Digestion coefficients	65.41	80.93	120.15	35.10	75.07	—	—	—
Digestible nutrients air dried	57.56	9.99	1.72	3.53	36.52	—	—	—

* Digestion coefficient for organic matter = 66.5%, nutritive ratio = 1:2.53.

† Digestjon coefficient for organic matter = 71.6%, nutritive ratio = 1:4.39.

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القيمة الغذائية لمخلوط من العلف ورجيع الكون المستخلص باستخدام تجارب هضم على الغنم

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الملخص

أجريت أربع تجارب هضم مزدوجة على الغنم (الدريس كعليقة أساسية) لايجاد القيمة الغذائية لرجيع الكون المستخلص ولمخلوط علف معين يتكون من ٦٥٪ كسب قطن غير مقشور ، ٢٠٪ ردة ، ١٢٪ رجيع كون ، ٢٪ مسحوق حجر جيرى ، ، ١٪ ملح طعام . وكان هذا المخلوط يحتوى على ١٦ر٢٣٪ بروتين ، ٧٢ر٨٪ دهن ، ٦٠ر١٨٪ ألياف ، ١٠ر٣٢٪ كربوايدرات ذائبة ، ٢٥ر١٢٪ رماد . ووجد أن معاملات الهضم للأربع مركبات الغذائية الأولى هى ٩٨ر٧٧ ، ٥٦ر٧٢ ، ١٠ر٣٤ ، ٩١ر٧٢٪ على الترتيب . وكانت المركبات المهضومة الكلية للمخلوط المأكول هى ٧١ر٦٣ والقيمة النشوية ١٨ر٥٦ مقابل ١٨ر٦٧ ، ٧٥ر٥٩ للمادة الجافة على الترتيب وكانت النسبة الزلالية ١ : ٥٣ر٢

وقد وجد أن القيمة الغذائية المستخرجة حسابيا من مكونات المخلوط بالاستعانة بجداول غنيم هى ٦٩ر٥٧ وهى لا تفترق عمليا عن المستخرج من تجربة الهضم مما يبين امكان الاعتماد على الطريقة الحسابية لمعرفة القيمة الغذائية لمخاليط علف تشابه هذا المخلوط فى مكوناته .

وفى حالة الرجيع المستخلص فكان يحتوى على ٣٥ر١٢٪ بروتين ، ٧٢ر١٪ دهن ، ٠٦ر١٠٪ ألياف ، ٦٥ر٤٨٪ كربوايدرات ذائبة ، ٢٢ر١٥٪ رماد . وكانت معاملات الهضم للأربع مركبات الغذائية الأولى هى ٩٣ر٨٠ ، ١٥ر١٢٠ ، ١٠ر٣٥ ، ٠٧ر٧٥٪ على الترتيب ، وكانت المركبات الكلية المهضومة للرجيع المستخلص المأكول هى ٩١ر٥٣ والقيمة النشوية ٠٧ر٥٠ مقابل ٦٢ر٦١ ، ٨٩ر٥٦٪ للرجيع الجاف تماما ، وكانت النسبة الزلالية ١ : ٣٩ر٤ ومن ذلك يتضح أن القيمة الغذائية للرجيع المستخلص تبلغ نحو ٧٥٪ من الرجيع العادى اذا اعتبر أن قيمته الغذائية ٦٥ معادل نشا . ويجب مراعاة ذلك فى القيمة النقدية لكل من الرجيع العادى والرجيع المستخلص .

كما نوقش الاختلاف الكبير فى تركيب الدريس كعليقة أساسية وكذلك الاختلاف فى معاملات الهضم لمركباته الغذائية مما يستدعى ضرورة تقدير معاملات الهضم لكل عينة دريس تستخدم كعليقة أساسية دون الاعتماد على متوسطات معاملات الهضم لمركبات الدريس السابق تقديرها على عينات أخرى .